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Two new species of *Psyttalia* Walker (Hymenoptera, Braconidae, Opiinae) reared from fruit-infesting tephritid (Diptera) hosts in Kenya

Robert A. Wharton

Departament of Entomology, Texas A & M University, College Station, TX

urn:lsid:zoobank.org:author:6AAF121C-A6DB-47B0-81EE-131259F28972

Corresponding author: *Robert A. Wharton* (rawbaw2@tamu.edu)

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Abstract

Two species of opiine Braconidae, reared from fruit-infesting Tephritidae in Kenya, are described. *Psyttalia masneri*, **sp. n.**, was reared from fruits of *Dracaena fragrans* (L.) Ker Gawl. (Liliaceae) infested with *Taomyia marshalli* Bezzi in western Kenya. *Psyttalia masneri* is the only opiine braconid known to attack members of the genus *Taomyia*. Unusual morphological features of *P. masneri* and its host are detailed. *Psyttalia halidayi*, **sp. n.**, was reared from fruits of *Lettowianthus stellatus* Diels (Annonaceae) infested with *Ceratitis rosa* Karsch in coastal Kenya. *Psyttalia halidayi* is morphologically similar to several described species of *Psyttalia* that have previously been used in the biological control of tephritid pests. Unlike these other species, *P. halidayi* can attack and successfully develop on *C. rosa*, a serious pest of cultivated fruits. A list of valid species in *Psyttalia* is provided, along with comments on species groups and host records.

Keywords

natal fly, Ceratitis, Tephritidae, cryptic species, biocontrol, fruit pests

Introduction

The braconid subfamily Opiinae includes over 100 available genus group names, with most of these currently in use by specialists as either genera or subgenera

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(Fischer 1971b, 1972a, b, 1977, 1982, 1984, 1986, 1987, 1998; van Achterberg 1997, 2004; van Achterberg and Salvo 1997; Wharton 1987, 1988, 1997, 2006). Fischer (1999), Tobias (1977, 1998), Wharton (1983, 1987, 1988, 1997, 2006), van Achterberg (1997, 2004), and Belokobylskij et al. (2003) continue to modify the classification proposed by Fischer (1972b, 1977, 1987), resulting in some instability in the usage of many of the genus group names. *Psyttalia* Walker, 1860 is the third-oldest available genus group name in the Opiinae, after *Ademon* Haliday, 1833 and *Opius* Wesmael, 1835. Due to its continued usage in current classifications, and its priority over the vast majority of other names now in use, a clear understanding of variability within *Psyttalia* is critical for improved classifications of this large subfamily of dipteran parasitoids.

Psyttalia is a moderately large genus. I recognize 79 valid species, largely following the works of Fischer (1972a, b, d, 1987, 1988, 1989, 1990, 1996, 2000). Fischer provided much of the fundamental work on *Psyttalia*, following its initial recognition as an opiine by Muesebeck (1931). Fischer (1963, 1972a, b, d, 1987) was the first to describe the distinctive metasomal features that separate *Psyttalia* from other opiines, and to note the similarities between *Psyttalia*, *Austroopius* Szépligeti and *Opius* (*Acidoxanthopius* Fischer). Fischer (1972b, d, 1987) also provided the morphological basis for delimiting species groups within *Psyttalia*, focusing on wing venation and propodeal sculpture. Wharton (1987) proposed *Austroopius* as a subgenus of *Psyttalia*, but later (Wharton 1997) abandoned subgenera due to lack of unambiguous features useful for defining each taxon as monophyletic. Wharton (1997) combined morphological and biological characters to suggest three informal species groups within *Psyttalia*, and also placed *Acidoxanthopius* as a synonym of *Psyttalia*. The discovery of two new species described below, both with unique host and host plant associations, provides an opportunity to reassess features that may ultimately be useful in segregating more rigorously defined, monophyletic groups within *Psyttalia*.

Forty percent of the species treated here have host records, and all confirmed hosts are members of the family Tephritidae, developing in fruits, flowers, or galls (Fischer 1987; Wharton 1997). Several of the species attacking fruit-infesting Tephritidae figure prominently in the history of biological control (Silvestri 1913; Clausen et al. 1965; Clausen 1978; Wharton 1989; Waterhouse 1993). Among the better-known species are *Psyttalia concolor* (Szépligeti), *P. humilis* (Silvestri), *P. incisi* (Silvestri), and *P. fletcheri* (Silvestri), all initially described in the genus *Opius*. Interest in the use of *Psyttalia* continues, with current efforts directed primarily against such notorious pests as *Bactrocera cucurbitae* (Coquillett), *Bactrocera oleae* (Rossi), and *Ceratitis capitata* (Wiedemann) (Mohamed et al. 2003, 2007; Vargas et al. 2004; Billah et al. 2005, 2008a, b; Yokoyama et al. 2005; Sime et al. 2006 a, b, c, 2007; Daane et al. 2008). Recent work (Kimani-Njogu et al. 2001; Karam et al. 2008; Rugman-Jones et al. 2009) confirms earlier studies (e. g. Fischer 1958) suggesting that *P. concolor* represents a complex of morphologically similar but genetically distinct populations, at least some

of which could be recognized as distinct species. One of these morphological similar, but genetically distinct entities is described here as a new species because of its ability to successfully develop on *Ceratitis rosa* Karsch, a notorious pest of fruits in Africa and nearby islands.

Materials and methods

Specimen acquisition. The two new species described here represent the most distinctive of the many undetermined *Psyttalia* reared from fruits collected in Kenya. Rearing methods, localities, and methods of identification of flies and plants are described in Copeland et al. (2002, 2006) and Rugman-Jones et al. (2009). Larvae of *Taomyia* Bezzi have the unusual habit of pupating within the fruits of *Dracaena fragrans* (L.) Ker Gawl. (Liliaceae), and had to be extracted therefrom to confirm host association and to examine morphology of the immature stages. *Psyttalia halidayi*, new species, was reared from a collection of fruits of *Lettowianthus stellatus* Diels (Annonaceae). *Ceratitis rosa* was the only fly present in this fruit sample. Most of the paratypes of *P. halidayi*, new species, are offspring of adults reared from field-collected fruit. They represent the last generation (all male) of a culture initiated and maintained on *C. rosa* by Samira Mohamed and Maxwell Billah at the International Centre of Insect Physiology and Ecology (ICIPE). Plant names are from the Tropicos website (http://www.tropicos.org) accessed 1 January 2009. Tephritid host names have been updated as needed from published host records using primarily Norrbom et al. (1998).

Specimens used for comparison were borrowed from, or examined while visiting, the following institutions (in addition to the Texas A&M University Insect Collection, TAMU): American Entomological Institute, Gainesville (AEIC), The Natural History Museum, London (BMNH), Bernice P. Bishop Museum, Honolulu (BPBM), Silvestri Collection, Dipartimento di Entomologia e Zoologia Agraria dell'Università, Portici (DEZA), Hungarian Natural History Museum, Budapest (HNHM), Museum National d'Histoire Naturelle, Paris (MNHN), Koninklijk Museum voor Midden-Afrika, Tervuren, Belgium (MRAC), Naturhistorisches Museum Wien, Austria (NHMW), Swedish Museum of Natural History, Stockholm (NHRS), Queensland Department of Primary Industries (QDPI), National Museum of Natural History, Washington, D. C. (USNM), Museum für Naturkunde der Humboldt-Universitaet, Berlin, Germany (ZMHB). Holotypes of the two new species will be deposited in the National Museums of Kenya (NMK). Abbreviations mostly follow Arnett et al. (1993). I have examined primary types for all of the species treated below, except as follows: *Psyttalia advenator* (Fischer), *P. agreutretoides* (Fischer), *P. alleni* (Fischer), *P. brevitemporalis* (Tobias), *P. carinata* (Thomson), *P. curis* (Fischer), *P. cyclogaster* (Thomson), *P. cyclogastroides* (Tobias), *P. danumica* Fischer, *P. darasunica* (Tobias), *P. flexicarina* (Fischer), *P. infuscata* (Granger), *P. kolomani* Fischer, *P. kuchingicola* Fischer, *P. lindbergi* (Fischer), *P. mediocarinata*

(Fischer), *P. niloticus* (Schmiedeknecht), *P. ovaliops* (Fischer), *P. papuensis* (Fischer), *P. proclivis* (Papp), *P. psyttaloides* (Fischer), *P. rhagoleticola* (Sachtleben), *P. romani* (Fahringer), *P. sakhalinica* (Tobias), *P. sequentator* (Fischer), *P. subcyclogaster* (Tobias), *P. subsulcatus* (Granger), *P. tamurensis* (Fischer), and *P. vacua* (Tobias). For placement of these, I have relied on the original descriptions, redescriptions by Fischer (1972b, 1987), and, for *P. rhagoleticola*, on paratypes. Fischer (1987) was unable to locate type specimens for several species described by Silvestri. For most of these, at least co-types were present in DEZA during my visit there in 1984.

Terminology and measurements

Measurements are as in Wharton (1977), with length of mesosoma taken in lateral view from anterior margin of mesoscutum diagonally to posterior-most point of metapleuron and eye/temple length measured in lateral view at level of ventral margin of torulus. Ratios are presented to the nearest 0.05. Ovipositors were dissected from one individual of each species to determine total length. Terminology for descriptions of venation and external features of the body follows Sharkey and Wharton (1997), except that in the present paper a distinction is made between the sternaulus and the precoxal sulcus, following van Achterberg (1993) and Wharton (2006). Additionally, the subtegular ridge, as used in the descriptions below, is an elevated structure of varying length and width located dorsally on the mesopleuron and separated from the tegula by weak to strong depression. T2 and T3 are used, respectively, to refer to the median tergites of the second and third metasomal tergum.

Dissections for examination of the venom apparatus were made primarily on specimens preserved in ethanol stored in a freezer. Where specimens were limiting, point-mounted specimens, originally preserved in ethanol and later dried through amyl acetate, proved suitable though more difficult to dissect.

Results and discussion

Psyttalia: diagnosis. *Psyttalia* is defined as monophyletic on the basis of the relatively short second metasomal tergum (T2). Unlike most other opiines (but unfortunately not all), T2 is shorter, and often much shorter, than the third metasomal tergum as measured along the dorsal midline (Fischer 1972a, b, d). Supporting features, treated here as derived within the Opiinae, include a medially elongate hypopygium (Figs 10, 20), loss of hind wing RS (Fig. 15), and the absence of a midpit on the mesoscutum (Figs 6, 8). One or more of these three features are found in numerous other opiines, but the combination of all three is rare. Additional characteristics that, in combination with the above, enable unambiguous identification of *Psyttalia* are the exposed, flat labrum (Figs 4, 18, 24), absence of

a basal tooth ventrally on the mandible (Figs 23–26), relatively elongate second submarginal cell (Figs 12–14) and relatively broad fore wing stigma (Figs 12–14). Confirmed hosts are all members of the family Tephritidae.

Psyttalia: species groups. Examination of available material confirms the existence of two morphologically distinct, informal groups within the genus as first noted by Fischer (1972d) and subsequently elaborated on by Fischer (1987) and Wharton (1997). The first group corresponds largely with Fischer's (1972d, 1987) group A and includes the *Psyttalia concolor* and *P. fletcheri* species groups of Wharton (1997), as well as species formerly included in *Austroopius* and *Opius* (*Acidoxanthopius*). Available host records suggest that members of this first group are almost exclusively parasitoids of fruit-infesting Tephritidae. The second group largely corresponding to Fischer's (1972d, 1987) group B and includes the *Psyttalia vittator* (Brues) species group of Wharton (1997). Following Wharton (1997), I am abandoning the use of subgenera at the present time, pending a more formal analysis of relationships, but recognize several species groups as defined in the remainder of this section.

Wharton (1987, 1988) attempted to subdivide the first group, those species that fall largely within Fischer's (1972d, 1987) group A, but was not entirely successful in doing so. For example, his recognition of the subgenera *Austroopius* and *Psyttalia*, based respectively on curvature of fore wing m-cu and presence of T2 sculpture, left the many unplaced species without a clear synapomorphy and also glossed over intraspecific variation and postmortem changes in T2 sculpture. Similar problems pertain to the use of internal features associated with the poison gland (Wharton 1997), and are compounded by the absence of data on gland morphology for the vast majority of species. Nevertheless, there are numerous species belonging to this group of fruit-infesting tephritid parasitoids, and further attempts to delineate species groups are warranted. I continue to recognize the *Psyttalia fletcheri* species group and include *P. amboiensis* (Fullaway), *P. fijiensis* (Fullaway), *P. fletcheri*, *P. incisi*, *P. lemiensis* (Szépligeti), *P. muesebecki* (Fischer), and *P. novaguineensis* (Szépligeti). Most of these species have 2RS thickened medially, the sole character traditionally used to define *Austroopius* (Szépligeti 1900; Fischer 1972b, 1987; Wharton and Gilstrap 1983). However, I define the *fletcheri* species group more broadly to include species such as *fletcheri* and *incisi*, while specifically excluding *P. insignipennis* (Granger). Members of the *fletcheri* species group are distinguished from all other *Psyttalia* on the basis of the wide angle formed between fore wing m-cu and 1CUb, with m-cu often broadly bowed towards 2RS. The first subdiscal cell is nearly always distinctly broadened distally in association with this diagnostic feature. Known members of the *fletcheri* species group are Indo-Pacific in distribution, and I have seen several undescribed species distributed from northeastern Australia through Malaysia which differ from described species primarily on the basis of differences in ovipositor length and fore wing venation. Intraspecific variation in thickness of 2RS is known both for species within the *fletcheri* species group (Wharton and Gilstrap 1983) and for species in other species groups (Wharton et al. 1999), but is

recorded here for the first time for a species from the African continent (see below under remarks for *P. halidayi*). Hosts are unknown for *P. amboiensis* and *P. lemiensis*, but all other members of the *fletcheri* species group are parasitoids of various species of *Bactrocera* Macquart (Silvestri 1916a; Clausen et al. 1965; Carmichael et al. 2005). These hosts have previously been placed in *Dacus* Fabricius, but I know of no confirmed records from *Dacus* as the latter genus is currently defined. Similarly, records of *P. incisi* from *Carpomya vesuviana* Costa (e. g. Wharton and Gilstrap 1983) need confirmation since these records apparently come from fruit samples with mixed infestations of *C. vesuviana* and *Bactrocera* spp., whereas large samples yielding only *C. vesuviana* failed to produce *P. incisi* (e. g. Clausen et al. 1965). *Psyttalia novaguineensis* has been recorded from several species of *Bactrocera* (Fischer 1987; Carmichael et al. 2005), and the sole record from *Euphranta* Loew (Fischer 1987) should also be verified.

Psyttalia acidoxanthicida (Fullaway) is a distinctive species for which Fischer (1972b) created the subgenus *Acidoxanthopius*. Vein 1M of the hind wing is somewhat thickened and distinctly bowed, yet the venation of the fore and hind wing is otherwise typical of *Psyttalia*. Distal expansion of the first subdiscal cell and more equal length of T2 and T3 suggest a placement closer to the *fletcheri* species group than to the *concolor* species group. Though T2 is shorter than T3 in *Psyttalia*, the relative length varies substantially with T2 very short in many of the African species and distinctly longer in many of the species in the *fletcheri* group. *Psyttalia acidoxanthicida* is further characterized by a reduced occipital carina and reduced sculpture on the propodeum and petiole. Fischer (1987) also placed *P. karubakaensis* (Fischer) in *Acidoxanthopius*. I have not had an opportunity to compare these two species directly but I tentatively include *karubakaensis* in this species group. *Psyttalia acidoxanthicida* was reared from *Acidoxantha* Hendel infesting buds of *Hibiscus* L. The host is thus atypical relative to known hosts of the *fletcheri* and *concolor* species groups, which, with only one exception noted below, attack fruits rather than buds.

Most of the remaining species of *Psyttalia* differ from one another by relatively smooth transitions in color, ovipositor length, sculpture, and venation. I am unable to divide them satisfactorily into distinct species groups despite several attempts to delineate a smaller subset as the *concolor* species group (Wharton and Gilstrap 1983; Wharton 1997; Kimani-Njogu et al. 2001; Rugman-Jones et al. 2009). Species such as *P. concolor*, *P. humilis*, *P. cosyrae* (Wilkinson), *P. perproxima* (Silvestri), and *P. phaeostigma* (Wilkinson) are capable of hybridizing (producing viable female offspring) when confined in small containers (Kimani-Njogu et al. 2001; Billah et al. 2008a) despite originating from genetically distinct populations and in some cases being morphologically distinct as well (Kimani-Njogu et al. 2001; Billah et al. 2008b; Rugman-Jones et al. 2009). Several cryptic species remain to be elucidated, and applying available names to various Afrotropical populations will continue to be a challenge (Rugman-Jones et al. 2009). My dissections of the reproductive tract reveal that these particular species also have a distinctive bulb associated with the venom apparatus that, in *P. concolor* at least, is filled with virus particles (Wharton 1997). In addition to these five species, a similar bulb is present in *P. halidayi*, one of the new species described below. The venom appa-

ratus of *P. lounsburyi* (Silvestri) and *P. masneri* are different, however, and I was unable to find a similar feature in females of the two specimens of *lounsburyi* and the one of *masneri* that I dissected. The bulb is also absent in four species of the *fletcheri* species group, *P. fijiensis*, *P. fletcheri*, *P. incisi*, and *P. novaguineensis* (Wharton 1997; Quicke et al. 1997), as well as in several other species examined by Quicke et al. (1997).

Until more work can be done on the venom apparatus, and perhaps hybridization experiments, I reluctantly include a large number of species in the *concolor* species group at the present time. Wharton (1997) and Rugman-Jones et al. (2009) already noted the similarity of *P. dacicida* (Silvestri), *P. dexter* (Silvestri), and *P. ponerophaga* (Silvestri) to the species with a bulb on the venom apparatus, noted above (*P. concolor*, *P. cosyrae*, *P. halidayi*, *P. humilis*, *P. perproxima*, and *P. phaeostigma*). Of the remaining species with host records, or at least reared from fruits, *P. efoveolata* (Szépligeti), *P. makii* (Sonan), *P. ophthalmica* (Tobias), *P. rhagoleticola*, and *P. walkeri* (Muesebeck) are also morphologically similar, whereas *P. distinguenda* (Granger) and *P. insignipennis*, both originally described from Madagascar, and *P. inquirenda* (Silvestri) and *P. inconsueta* (Silvestri), from Cameroon and Nigeria respectively, have (RS+M)b less distinct and often absent. In Belokobylskij et al. (2003), a suggestion is made that *P. carinata* is a senior synonym of *P. rhagoleticola*, but I have not had an opportunity to verify this and thus retain the two as valid (as do Fischer and Koponen 1999). *Psyttalia somereni* (Fischer) and *P. lounsburyi* are distinctly darker species, and Fischer (1987) separates *P. somereni* from most other species on the basis of the absence of a median keel on the extensively rugose propodeum. I have not seen *P. brevitemporalis*, another species with a host record, but the original description is consistent with membership in the *concolor* species group. Based on examination of primary types, I include the following in the *concolor* species group and predict that they also attack fruit-infesting tephritids: *P. bisulcata* (Szépligeti), *P. haemaelaeineni* Fischer, *P. hemicauda* (Fischer), *P. palpalpis* (Szépligeti), *P. pusilla* (Szépligeti), *P. tshuapana* (Fischer), and *P. yangambiana* (Fischer). Fischer (2001) noted that *P. haemaelaeineni* was exceptional in that it is the only species of *Psyttalia* with a midpit on the mesoscutum. However, the species is known from a single, somewhat shriveled male and the shallow midpit may be a preservation artifact. Biological information is also lacking for the following species, but based on the descriptions by Tobias (1998) and redescriptions by Fischer (1987), I include them in the *concolor* species group: *P. alleni*, *P. cyclogastroides*, *P. darasunica*, *P. romani*, *P. sakhalinica*, and *P. vacua*. I specifically exclude *P. curis* (Fischer) from the *concolor* species group because the fore wing venation and stigma, as figured in Fischer (1990), are unusual.

There are numerous host records for members of the expanded *concolor* species group as defined here. A few species, notably *P. efoveolata*, *P. inquirenda*, *P. somereni*, and *P. walkeri*, have been reared only from fruits, with the host fly unknown (Silvestri 1913; Fischer 1972a, b, c). Three of the species, *P. dacicida*, *P. lounsburyi*, and *P. ponerophaga*, are parasitoids of olive fly, *B. oleae* (Silvestri 1912, 1913, 1916b; Copeland et al. 2004; Sime et al. 2007; Daane et al. 2008), and have thus far been recorded only from this host. *Psyttalia concolor* is also a parasitoid of *B. oleae* and was originally described from specimens reared from olives. It is capable of attacking a wide variety of other fruit-

infesting tephritids both in its native range and in areas where it has been introduced. In addition to *Bactrocera*, known hosts include species in the genera *Anastrepha* Schiner, *Ceratitis* MacLeay, *Capparimyia* Bezzi, *Carpomya* Costa, and *Dacus* Fabricius (Wharton and Gilstrap 1983). *Psyttalia makii* has been recorded from both *Bactrocera* and *Carpomya* (Wharton and Gilstrap 1983) while *P. dexter*, *P. perproxima*, and *P. phaeostigma* have all been reared from various species of *Dacus* (Silvestri 1913; Steck et al. 1986; Kimani-Njogu et al. 2001). *Psyttalia perproxima* is primarily a parasitoid of various *Ceratitis* and *Trirhithrum* Bezzi species while *P. phaeostigma*, which is mainly known as a parasitoid of *Dacus ciliatus* Loew and other cucurbit pests, has additionally been recorded from *Ceratitis* and *Carpophthoromyia*. *Psyttalia cosyrae*, *P. distinguenda*, *P. humilis*, and *P. insignipennis* have all been reared from species of *Ceratitis* (Silvestri 1913; Wilkinson 1927; Wharton et al. 1999; Mohamed et al. 2003), though *insignipennis* may have a broader host range (Wharton et al. 1999) and *humilis* may have been reared on other hosts at least briefly during attempts to redistribute it from Hawaii for biological control of other tephritid pests (Clausen et al. 1978; Wharton 1989). The temperate species *P. ophthalmica* and *P. rhagoleticola* are both parasitoids of *Rhagoletis* (Fischer 1972b; Tobias 1977) and *P. brevitemporalis* was described from specimens reared from a species of *Myoleja* (Tobias 1998). Finally, Silvestri (1913) recorded *P. inconsueta* from *Carpophthoromyia tritea* Walker. Though Fisher (1987) placed *inconsueta* in his group B, based on the wing venation as illustrated by Silvestri (1913), the species is otherwise more similar in sculpture and facial features to other members of the *concolor* species group, and at least one of the wings on the type series has fore wing m-cu interstitial rather than postfurcal.

Although the hosts recorded above for the *concolor* species group are fruit-infesting tephritids, the only known host of *P. dexter* develops in fruits that are pod-like (Silvestri 1913). Similarly, I have seen specimens that are not easily distinguished from *P. concolor*, reared from *Coelotrypes* Bezzi infesting flowers of Convolvulaceae. Thus, a few caveats need to be attached to the generalizations about the types of hosts attacked by members of the *concolor* species group. Also, because of the evidence for host associated differentiation in this group, as exemplified by *P. halidayi*, published host records need to be carefully verified.

There are two species that have fore wing venation typical of the *concolor* species group (Figs 12, 14), but sculptural features of the *vittator* species group treated in the next paragraph. *Psyttalia masneri* is more heavily sculptured than nearly all other species reared from fruit-infesting tephritids and shares sculptural and other features with *P. paralleni* (Fischer). I place them together in the *paralleni* species group based specifically on the distinctly sculptured lower gena and narrower clypeus (Figs 16, 18, 23) relative to members of the *concolor* species group (Figs 3, 4, 25). The propodeum is also heavily sculptured (Figs 21, 22), but members of the *concolor* species group are quite variable in this regard, as exemplified by differences between the nearly smooth *P. concolor* and the extensively rugose *P. somereni*. The two members of the *paralleni* species group are thus somewhat transitional between the *concolor* and *vittator* species groups. The narrow clypeus and heavier sculpture are characteristic features of the *vittator* species group, but the venation, with a distinct (RS+M)b and relatively vertical

m-cu, is typical of the *concolor* species group. Hosts are known only for *P. masneri*, which attacks *Taomyia* developing in fruits of *Dracaena*.

A few species of *Psyttalia* attack gall-making and/or flower-infesting tephritids, and I include all of these in the *vittator* species group. Species with known hosts include *P. agreutretae* (Wilkinson) recorded from *Cosmetothrix discoidalis* (Bezzi), *Afreutreta bipunctata* (Loew) *and Afreutreta muiri* (Bezzi); *P. gigantura* (Fischer) reared from flower heads; *P. leveri* (Fullaway) reared from *Sphaeniscus sexmaculatus* (Macquart); *P. phorelliae* (Wilkinson) reared from *Cryptophorellia peringueyi* (Bezzi); and *P. sanctamariana* (Fischer) reared from *Spathulina acroleuca* (Schiner). These host data are from original descriptions (Wilkinson 1927, 1929; Fullaway 1953; Fischer 1972a, 1978), and I have observed *P. leveri* attacking this same host in flower heads of *Hyptia* sp. (Lamiaceae) in Malaysia. I have also seen one specimen determined as *P. vittator* reared from unknown tephritids in flower heads (Fig. 26). Comparison of the holotype of *P. vittator* with this and several other, undetermined South African specimens reared from various flower heads and galls indicates that none of the reared material belongs to *P. vittator*. However, all of them are very similar to *vittator* and all belong to this species group based on the postfurcal placement of fore wing m-cu (Fig. 14), the short, broad mandible (Figs 24, 26), distal placement of the spiracle of the petiole, and the heavily sculptured propodeum. Relative to species that attack fruit-infesting Tephritidae, the scutellum of these species is densely setose and usually coarsely sculptured posteriorly, and this area is usually separated from the main part of the scutellum by a short, transverse ridge. I also place the following in the *vittator* species group and based solely on their morphology, I predict that they all attack gall-forming or flower-infesting tephritids: *P. hypopygialis* (Szépligeti), *P. javanus* (Szépligeti), *P. kuchingicola*, *P. ngomeensis* (Fischer), *P. novoirlandicus* (Fischer), *P. philippinensis* (Ashmead), *P. puncticranium* (Fischer), and *P. urogramma* (Fischer). *Psyttalia agreutretoides*, *P. kirstenboschensis* (Fischer) and *P. lindbergianus* (Fischer) are tentatively included in the *vittator* species group since they generally conform in morphology but have a more weakly sculptured propodeum.

I do not have sufficient information for species group assignment of the following, but based on descriptions and redescriptions (Fischer 1972b, 1987, 1989; Tobias 1998), all of these may also belong to the *vittator* species group: *P. advenator*, *P. cyclogaster*, *P. infuscata*, *P. niloticus*, *P. papuensis*, *P. proclivis*, *P. prothoracalis* (Fischer), *P. psyttaloides*, *P. subcyclogaster*, *P. subsulcatus*, and *P. tamurensis*. I previously excluded *testaceipes* Cameron (type species of *Mesostoma* Cameron) from *Psyttalia* (Wharton 1988) because it lacked more typical mandibular, wing venation, and clypeal features of the *concolor* and *fletcheri* species groups. I failed to consider the possibility that it belongs in the *vittator* species group, and now tentatively include it here primarily on the basis of clypeal and mandibular morphology. I specifically exclude *P. danumica* and *P. kolomani* from the *vittator* species group, despite the fact that fore wing m-cu enters the second submarginal cell, and thus leave them unplaced in *Psyttalia*. Fischer (2000) noted that *danumica* was morphologically distinct from all other *Psyttalia*, and *kolomani* lacks the distinctive sculpture, especially on the propodeum, of other members of this species group. Members of the *vittator* species group, as treated here, were included

by Fischer (1987) in his group B, with the exception of *P. leveri*. Examination of a series of 20 specimens from the type locality of *P. leveri* indicates that the venation shown in Fig. 14 is typical, and that this species readily fits into the *vittator* species group. As is true of some other members of this species group, the propodeum is so heavily sculptured that the median carina is indistinct.

Nomenclature. Wharton (1987) elevated *Psyttalia* to generic rank but in this and subsequent publications (Wharton 1988, 1997; Wharton et al. 1999) formally transferred less than half of the species treated here. Further transfers were made by Koponen (1989), Fischer (1996, 2001), Quicke et al. (1997), Fischer and Koponen (1999), Tobias (2000), Papp (2004), and Fischer and Madl (2008). Twenty-one species appear as new combinations in Yu et al. (2005), though this is not clearly indicated under the species treatments in that work. *Psyttalia inquirenda*, *P. palpalis*, and *P. efoveolatus* are the only new combinations in *Psyttalia* in the present study.

I specifically exclude the following species that were included by Yu et al. (2005) in *Psyttalia*, and leave them either unplaced in *Opius* s.l. or in the subgenera where Fischer (1972b, 1977, 1987) previously placed them: *Opius flexicarina* Fischer, *O. lindbergi* (Fischer), *O. mediocarinata* Fischer, *O. ovaliops* (Fischer), *O. rufoflava* (Fischer), new combination, and *O. sequentator* (Fischer). I exclude *flexicarina*, even though originally described in the subgenus *Psyttalia* (Fischer 1975), because of differences in the propodeal carination and especially the fore wing stigma. Similarly, I retain *mediocarinata* in *Opius*, following Fischer (1972b) rather than Tobias (2000). I also exclude two New World species, *ovaliops*, tentatively placed in *Psyttalia* by van Achterberg and Salvo (1997) and *rufoflava*, originally described in *Psyttalia* by Fischer (2001). These are both members of different New World species groups and do not closely resemble one another. Koponen (1989), followed by Yu et al. (2005), lists the valid name for *Opius caboverdensis* Hedqvist as *Psyttalia sequentator*, citing Hedqvist's (1965) mention of *caboverdensis* as similar to *sequentator*. However, Fischer (1972b) places *caboverdensis* and *sequentator* in different subgenera, neither of them *Psyttalia*. Koponen (1989) also cites Wharton (1987), but Wharton (1987) did not treat either of these nominal species. I exclude *sequentator* from *Psyttalia* as it does not have the morphological features that characterize this genus and agree with Fischer (1972b) in retaining both *caboverdensis* and *sequentator* as valid.

Confusion surrounding homonyms has resulted in the erroneous placement of *lindbergi* and the species originally described as *Eurytenes pusillus* Szépligeti, 1913b. Koponen (1989), followed by Yu et al. (2005), mistook *lindbergi* Fischer for *lindbergi* Hedqvist. The latter, rather than the former, was renamed *lindbergiana* by Fischer (1971a) and belongs in *Psyttalia*. See Fischer (1972b) for correct treatment of *lindbergi* Fischer and *lindbergi* Hedqvist. Szépligeti (1913a, b) used the name *pusillus* for two nominal species of Opiinae. Fischer (1961) subsequently transferred *Eurytenes pusillus* Szépligeti, 1913b to *Opius* and Wharton (1988) transferred *Opius pusillus* Szépligeti, 1913a to *Psyttalia*, noting that this was not the same species as *Opius pusillus* (Szépligeti, 1913b). Fischer (1971a, 1972a, b, 1987) treated only *O. pusillus* (Szépligeti, 1913b), and perhaps as a consequence, Yu et al. (2005) incorrectly

recorded the valid name of *Eurytenes pusillus* Szépligeti, 1913b as *Psyttalia* (*Psyttalia*) *pusillus*. The male type of *Psyttalia pusilla* is in ZMHB, but is labelled "quadripusillus," which may explain why it has gone unrecognized for so long. It is likely that Szépligeti had only one specimen when he described this species, but since this is not perfectly clear from the original description, I designate this distinctively labeled specimen as the lectotype.

Descriptive taxonomy

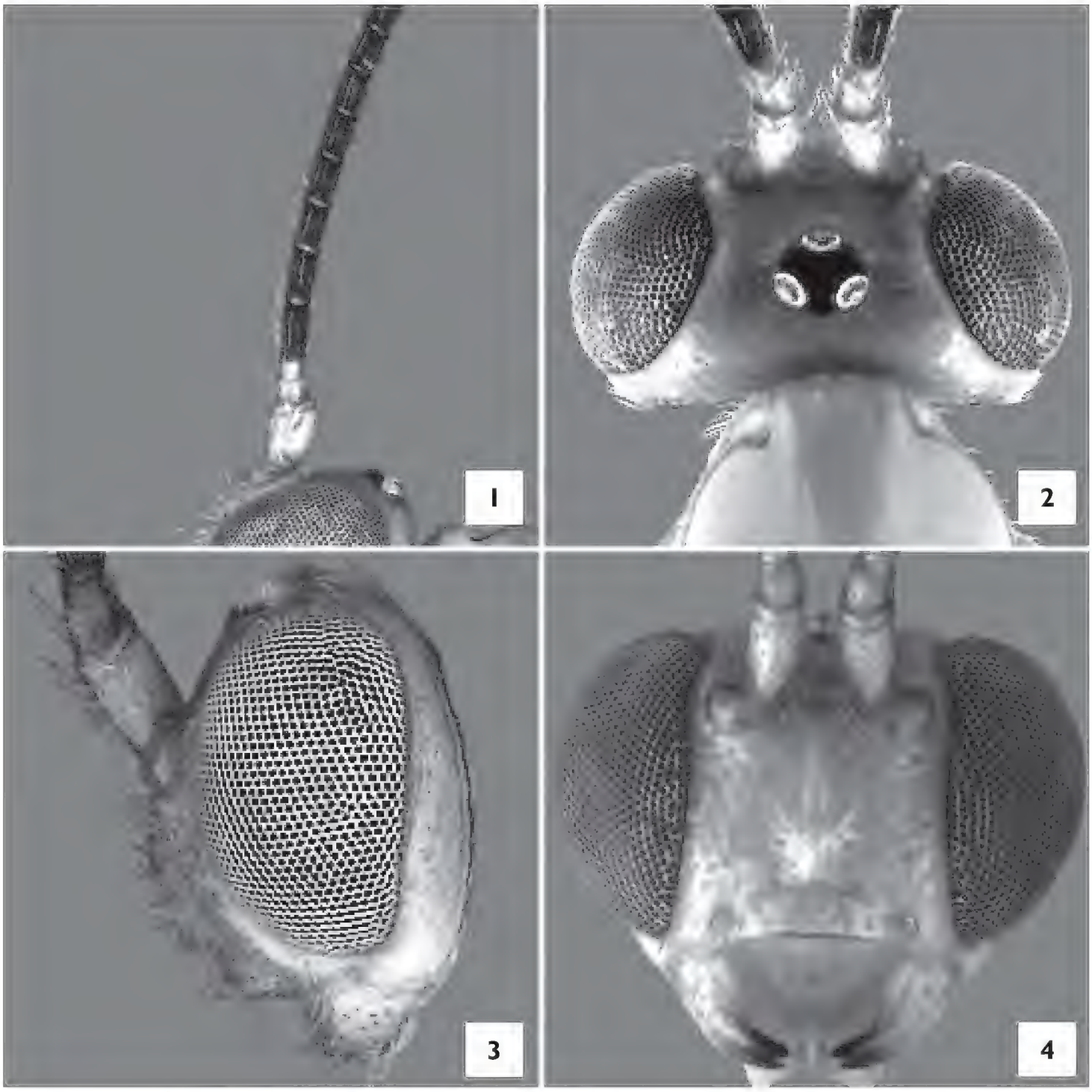
***Psyttalia halidayi* Wharton, sp.n.**
urn:lsid:zoobank.org:act:B48EB272-94A6-436F-B39F-4DEC46268A86
Figs 1–12, 25

Type locality. Kenya, Coast Province, Mrima Hill, 4°29.32'S, 39°15.27'E.

Type material. Holotype. Female (NMK), with labels as follows: "KENYA: Coast Province / Mrima Hill, 17.x.2000 / 4°29.32'S, 39°15.27'E / R. Copeland, #920" "reared from Ceratitis / rosa in fruits of / Lettowianthus stellatus" "HOLOTYPE / Psyttalia / halidayi / Wharton" [red handwritten label.]

Paratypes (TAMU, NMK, ICIPE): 4 females, 13 males, same data as holotype; 22 males, same data except with additional label "bred in lab at ICIPE 2001 on C. rosa." The latter represent the last generation of a culture initiated at ICIPE (in Nairobi, Kenya) from some of the females that emerged from the Mrima Hill sample.

Description. Female (Fig. 10). **Head** (Figs 1–4, 25): Frons, vertex, occiput, and gena polished, face appearing less polished due to punctation; frons weakly punctate and sparsely setose along eye margin, bare medially, with shallow median pit between antennal toruli, frons very weakly wrinkled on either side of pit; gena completely unsculptured; face deeply punctate throughout, punctures separated by about their own diameter except more widely spaced near margin of clypeus. Face 1.60–1.75 × wider than high. Width of ocellar field 1.45–1.55 × distance from lateral ocellus to eye. Eyes in dorsal view distinctly bulging beyond temples; eye in lateral view very large, 6.00–7.15 × longer than temple. Malar space nearly absent, 0.05–0.10 × width of clypeus, about 0.10–0.15 × basal width of mandible; malar sulcus present but very short, difficult to discern. Clypeus 2.9–3.2 × wider than high, slightly protruding ventrally in profile, ventral margin evenly, shallowly concave; surface uniformly punctate, punctures more widely scattered than on most of face; anterior tentorial pits large, round. Mandibles with dorsal tooth longer than ventral tooth, ventral tooth only weakly twisted medially. Occipital carina widely separated from hypostomal carina ventrally; sharp and distinctly elevated throughout, extending dorsally just below top of eye in lateral view, weakly reflected medially at dorsal terminus; anterior margin impressed and weakly crenulate, especially dorsally. Hypostomal carina protruding as a short, low flange beneath mandible when mandible closed. Antenna with 44–46 flagellomeres; first flagellomere 2.4–3.1 × longer than wide, 1.10–1.25 × longer than second, twen-



Figures 1–4. *Psyttalia halidayi* sp. n., paratype female, head **1** Base of antenna, lateral view **2** Dorsal view **3** Lateral view **4** Face.

tieth flagellomere 1.7–2.0 × longer than wide; apical flagellomere with long, spine-like extension at tip. Maxillary palps considerably longer than height of head.

Mesosoma (Fig. 8) 1.2–1.3 × longer than high, 1.85–1.90 × longer than wide; 1.45–1.50 × higher than wide. Pronotum dorsally with distinct median pit and transverse, weakly crenulate sulcus laterad pit, otherwise polished, with two transverse rows of setae; pronotum laterally with transverse sulcus visible as short, deep, pinched groove at dorsal extremity; vertical carina present all along and adjacent to anterior margin, more strongly elevated dorsally; posterior margin weakly crenulate from ventral corner to level of mesothoracic spiracle; surface otherwise completely smooth and polished. Propleural flange small but distinct, flat or nearly so, not strongly bent posteroventrally; not separated from remainder of propleuron by a sculptured groove. Notaulus a

small dimple, not extending to anterior margin of mesoscutum; scattered setae present around notaulus, extending as a widely spaced row to tegula, setae on disc of mesoscutum varying from 2 pairs to none; midpit absent; lateral margin of disc acarinate between notaulus and tegula, sharply carinate posteriorad tegula. Scutellar sulcus narrow (Fig. 8), with 6–8 distinct ridges. Scutellum weakly convex, polished throughout. Metanotum with small, nearly flat median plate on posterior half, median carina on anterior half not extending onto posterior plate. Propodeum largely smooth and polished; with slightly irregular (wrinkled), median longitudinal carina bifurcating near middle to form a triangular areola over posterior 0.4–0.6; propodeum separated from metapleuron by shallow, weakly rugulose depression containing spiracle; depression pit-like anteriorly at margin of metanotum, propodeal side of depression margined by sinuate carina and, adjacent spiracle, an elevated boss; rarely with trace of additional carina on metapleural side of spiracle. Metapleuron broadly impressed and rugose around anterior, dorsal, and ventral dorsal margins; median plate polished, punctate, otherwise unsculptured. Mesopleuron largely polished and unsculptured, with band of setae and associated weak punctures extending from subtegular ridge to hind coxa; sulcus along hind margin of mesopleuron unsculptured throughout. Crenulate precoxal sulcus straight, extending over middle 0.3–0.5 of mesopleuron, incomplete anteriorly and posteriorly. Sternaulus absent.

Fore wing (as in Fig. 12) with stigma broad, wedge-shaped, widest at origin of r, tapered into metacarpus distally; r arising basad midlength, r distinctly shorter than width of stigma at junction of r; second submarginal cell large, weakly converging distally, 4-sided, m-cu distinctly antefurcal, basal portion of 2M bent posteriorly, 2RS reclivous, varying from weakly bowed to slightly bent, without medial thickening, r-m completely depigmented and desclerotized; 3RSa 4.0–4.6 × longer than r; 3RSb extending to wing margin very close to wing apex; (RS+M)a very weakly sinuate, nearly straight, arising near parastigma, 1RS 3.3–3.6 × longer than wide, 0.15–0.20 × length of 1M; (RS+M)b swollen throughout, thicker basally than distally, thickened part slightly longer than 1CUa; 1M 1.95–2.20 × longer than m-cu, m-cu straight to weakly bowed; 3M tubular and distinctly pigmented over about basal 0.3, spectral and depigmented distally; 1cu-a inclivous, separated from 1M by distinctly more than its own length, 1CUa thickened throughout; 1st subdiscal cell closed, gradually but distinctly widening distally, 2CUa strongly inclivous, about twice length of tubular, strongly reclivous 2cu-a; 1-1A weakly bowed towards wing margin, separated near mid-length from the latter by 2.5–3.0 × its width. Hind wing (as in Fig. 15) with RS absent or present only as a very short, basal stub; 2M weakly but distinctly pigmented for most of its length; m-cu absent; 2-1A usually absent.

Metasoma (Fig. 11) with petiole 1.2 × longer than apical width, apex 1.6–1.7 × wider than base; dorsal carinae slightly converging and becoming evanescent a little beyond mid-length, never meeting, replaced by median elevation over apical half, outline of dorsal carinae and median elevation hour-glass shaped in dorsal view; flat laterally, depressed medially between bases of dorsal carinae, both areas smooth, polished; median elevation weakly rugulose and punctate anteriorly, becoming smooth

Figures 5–8. *Psyttalia halidayi* sp. n., paratypes **5** Male metasoma and part of mesosoma, dorsal oblique view **6** Male mesonotum **7** Propodeum and petiole, dorsal view **8** Female mesonotum.

near posterior margin; dorsal and lateral carinae meeting at base above small, round laterope, dorsope absent. T2 distinctly shorter than T3; T2 spiracle at lateral edge of a clearly delimited plate between median and lateral tergites. Hypopygium weakly sclerotized medially, folded along midline; long, with posterior margin strongly protruding medially, extending to tip of metasoma; densely covered with long, nearly erect setae. Ovipositor protruding distinctly beyond metasoma, 2.4 × longer than mesosoma,

upper valve with distinct subapical node subtended by a weak notch, the node tapering gradually to a sharp point at apex; ovipositor sheath 1.5 × length of mesosoma, with 2–3 irregular rows of setae along entire length, setae, except at extreme tip, longer than width of sheath.

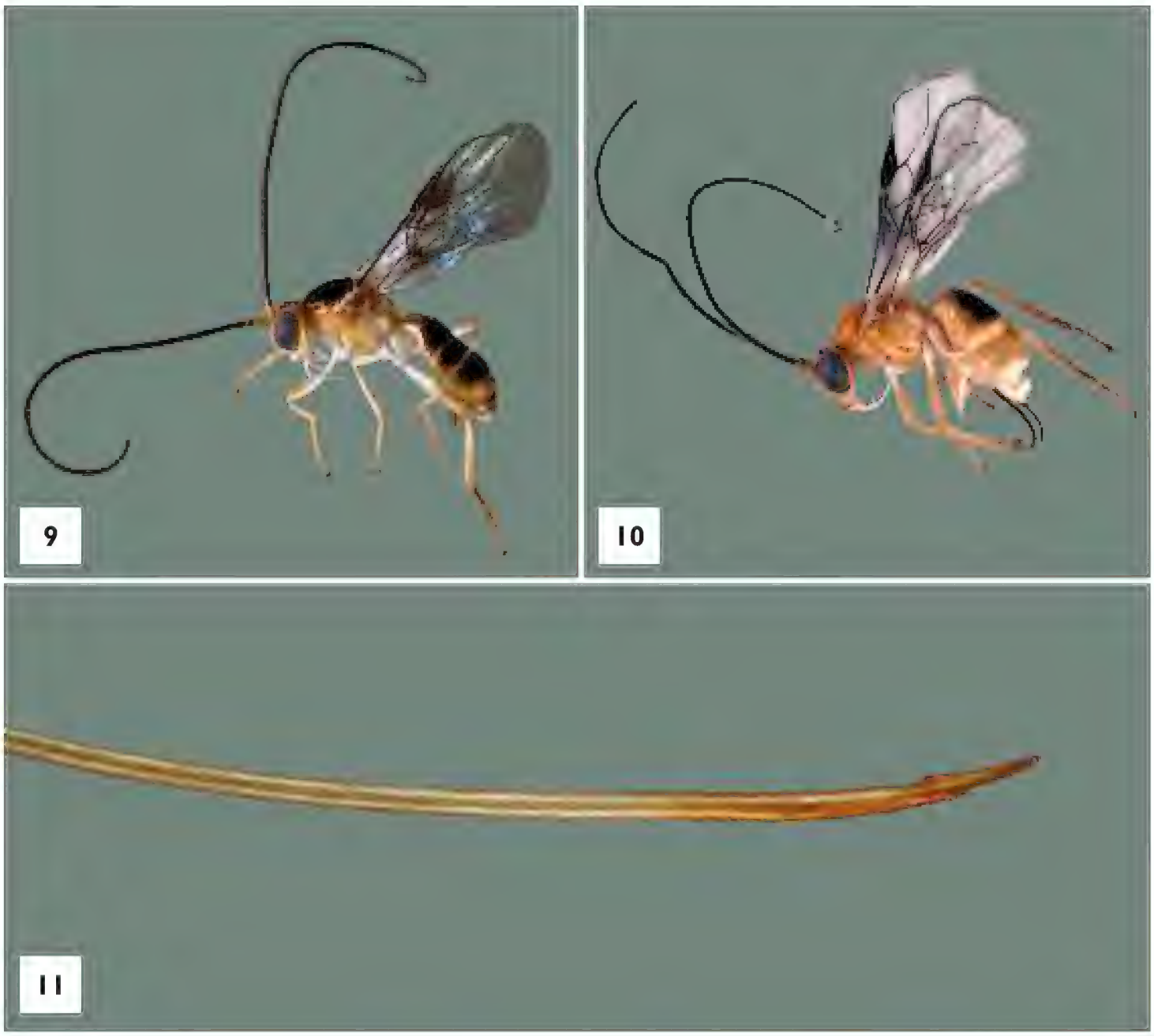
Color. Mesonotum, metanotum, top of head, most of face, and apical 0.15 of ovipositor sheath orange; scape, usually pedicel, orbital ring, tegula, mesopleuron, most of margin and posterior corner of pronotum laterally, propodeum, all femora, fore and mid tibiae and tarsi, and metasoma basally, apically, and laterally yellow; propleuron pale yellow; base of mandible, palps, labrum, malar region, lower gena, middle of pronotum laterally, metapleuron, all coxae, trochanters, trochantelli, and often posterior face of hind femur, and metasomal sterna white to very pale yellow; flagellum, apical teeth of mandible, most of dorsal portion of T2–4, usually base of T5, basal 0.85 of ovipositor sheath, and often hind basitarsus dark brown to black; hind tarsus otherwise brown; hind tibia dark yellow, usually infumate dorsally at base and over apical half; apex of petiole usually infumate; wings hyaline, stigma and most veins dark brown, most of M+CU and 1-1A yellow.

Length of body (exclusive of antenna and ovipositor) 3.2–4.0 mm; of wing 3.4–3.8 mm; of antenna about 6.0 mm.

Male (Figs 5–7, 9, 12, 15) as in female except as follows: size more variable, body length 2.9–3.3 mm; antenna with 44–48 flagellomeres, twentieth flagellomere 1.5–1.8 × longer than wide; temple slightly broader, in lateral view eye 4.45–4.60 × longer than temple, but with malar space very short as in female; precoxal sulcus rarely somewhat longer; fore wing 2RS occasionally (20%) with abrupt change in angle, the junction infrequently (10%) thickened, first subdiscal cell sometimes less distinctly expanded distally; petiole more variable, 1.25–1.45 × longer than apical width; body and wing length somewhat smaller, 2.9–3.3 and 3.0 mm respectively. Color as in female except mesoscutum brown to dark brown with narrow, pale streaks along notaular lines and on each side between notaulus and tegula, T5 always dark brown, dark portions of T2–5 extending further laterally than in female, face and hind femur mostly very pale yellow to white.

Biology. Reared from larvae of *Ceratitis rosa* (Diptera: Tephritidae) infesting fruit of the annonacean *Lettowianthus stellatus* in lowland areas of coastal Kenya, specifically Mrima Hills (see material examined section for details). Collections of host plant and host insect were also made in nearby Shimba Hills, but no parasitoids were reared at the Shimba Hills locality. Emergence, as in all known opiines, was from the host puparium. Host stage normally attacked is unknown, but females reared from field-collected fruit successfully oviposited in third instar larvae of *C. rosa* in the lab at ICIPE.

Diagnosis. This species is a member of the *Psyttalia concolor* species group, as defined above, and is differentiated from other members of this group by the combination of the sexually dimorphic color pattern of the mesoscutum (Figs 6, 8), large eye, long ovipositor, presence of a rounded bulb near the base of the venom apparatus, and relatively long, basally thickened (RS+M)b. Previously described species, where both sexes are known, have the mesosoma either completely pale or much more extensively



Figures 9–11. *Psyttalia halidayi* sp. n., paratypes **9** Male habitus **10** Female habitus **11** Ovipositor shaft.

darkened in both males and females. *Psyttalia halidayi* also has a larger eye relative to other species known to have the venom gland bulb. Variation in the shape and thickness of fore wing 2RS is similar to that found in the pale-colored *P. insignipennis*, and may indicate a relationship between these two species.

Remarks. Males exhibit more variation than females, but this may simply be a reflection of the larger number of male specimens available for study. About 10% of the male paratypes of *P. halidayi* have a knob-like thickening on 2RS that is more similar in appearance to the shape of 2RS in *P. insignipennis* than the more gradual swelling characteristic of *P. fijiensis* and *P. novaguineensis*. In *P. insignipennis*, initially described from Madagascar and subsequently recorded from Reunion (Wharton et al. 1999), both sexes are pale.

The appearance of finely shagreened sculpture on metasomal T2 is somewhat preparation dependent, thus decreasing its value as a character for differentiating groups within *Psyttalia*, as proposed by Wharton (1987). In most specimens of *P. halidayi*, sculpture is confined to the narrow band adjacent the T2/T3 suture.

In a separate study (Rugman-Jones et al. 2009), several populations of *Psyttalia* from different hosts and host plants were examined to determine levels of genetic differentiation. The type series from Mrima Hill represents one of these populations, and proved to be the most divergent Afrotropical population sampled. Given the diversity shown by Rugman-Jones et al. (2009) for a relatively small set of populations of *Psyttalia* together with the rearing of *Psyttalia* from many of the fruits sampled by Copeland et al. (2002, 2006), I predict that diversity of *Psyttalia* in the Afrotropics will be similar to that shown by Smith et al. (2008) for the microgastrine braconid genus *Cotesia* Cameron in Costa Rica.

This species was chosen for description among the several similar *Psyttalia* reared from fruit in Kenya because of its apparent preference for *C. rosa*, an unsuitable host for *P. concolor* and *P. cosyrae* in Kenya (Mohamed et al. 2003, 2007). It is named after A. H. Haliday, for his pioneering work on Braconidae in the early 1800s.

***Psyttalia masneri* Wharton, sp.n.**
urn:lsid:zoobank.org:act:1695DA91-DC03-41EF-9C6C-6615877718F9
Figs 13, 16–23

Type locality. Kenya, Western Province, Kakamega Forest, 0°13.44'N, 34°53.44'E.

Type material. Holotype. Female (NMK), with labels as follows: "KENYA: Western Province/ Kakamega Forest, 1630m/ 0°13.44'N, 34°53.44'E/ 25.i.2000, #446/ R. Copeland" "reared from Taomyia/ marshalli in fruits of/ Dracaena fragrans" "HOLOTYPE / Psyttalia / masneri / Wharton" [red handwritten label.]

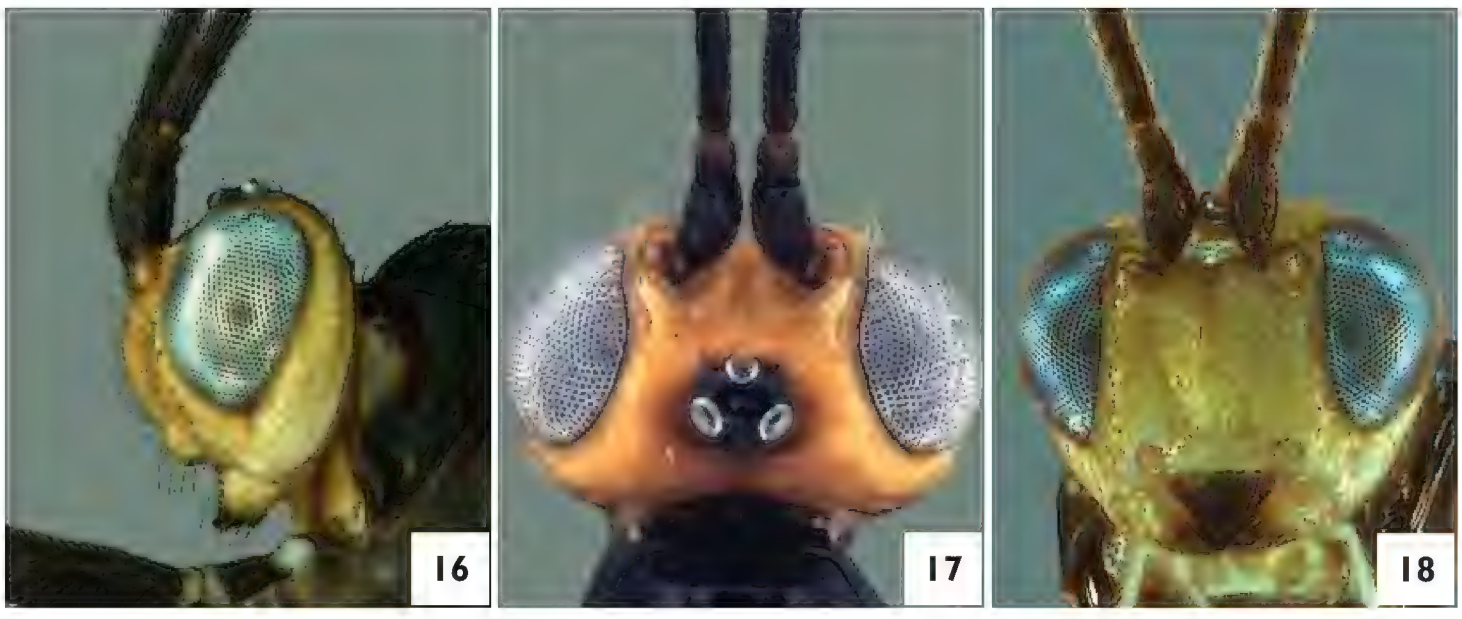
Paratypes (TAMU, NMK, ICIPE): 7 females, 3 males, same data as holotype; 1 male, same data as holotype except 6.vi.2001, collection # 1302; 1 female, same data as holotype except 0°14.51'N, 34°51.94'E, 13.iv.1999, collection #69, Voucher specimen # 655 DNA, Texas A&M University; 1 female, same data as holotype except 0°14.51'N, 34°51.94'E, 4.iii.1999, R. Copeland, R. Wharton, collection #31.

Description. Female (Fig. 20). **Head** (Figs 16–18, 23): Frons, vertex, occiput, and gena polished; frons weakly punctate and setose along eye margin, otherwise as in *halidayi*; gena distinctly striate ventrally, laterad malar sulcus; face heavily sculptured, with deep punctures coalescing to form somewhat transverse rugae. Face 1.4–1.6 × wider than high. Width of ocellar field 1.3–1.4 × distance from lateral ocellus to eye. Eyes in dorsal view distinctly bulging beyond temples; eye in lateral view 3.8–4.2 × longer than temple. Malar space long, 0.55–0.70 × width of clypeus, about 0.65–0.80 × basal width of mandible; malar sulcus deep, distinct. Clypeus relatively tall, narrow, 1.85–2.00 × wider than high, triangular in outline, nearly flat in profile, ventral margin very shallowly concave; surface sparsely punctate; anterior tentorial pits large, round. Mandibles with dorsal tooth longer than ventral tooth, ventral tooth strongly twisted medially. Occipital carina widely separated from hypostomal carina ventrally; sharp and distinctly elevated throughout, extending dorsally distinctly below top of eye in lateral view, strongly reflected medially at dorsal terminus; anterior margin im-

Figures 12–15. Wings. **12** *Psyttalia halidayi* sp. n., paratype male, fore wing **13** *Psyttalia masneri* sp. n., paratype female, fore wing **14** *Psyttalia leveri* (Fullaway) fore wing **15** *Psyttalia halidayi* sp. n., paratype male hind wing.

pressed and weakly crenulate, especially dorsally. Hypostomal carina protruding as a short flange beneath mandible when mandible closed. Antenna with 44–46 flagellomeres; first flagellomere 2.50–2.75 × longer than wide, 1.15–1.20 × longer than second, twentieth flagellomere 1.50–1.85 × longer than wide; apical flagellomere with long, spine-like extension at tip. Maxillary palps considerably longer than height of head.

Mesosoma (Figs 21, 22) 1.3–1.4 × longer than high, 1.8–1.9 × longer than wide; 1.3–1.4 × higher than wide. Pronotum dorsally with median pit indistinguishable within transverse, crenulate sulcus, otherwise polished, with two transverse rows of setae; pronotum laterally with transverse sulcus extending ventrally along posterior side of sharp vertical carina, carina distinctly distant from anterior margin, weaken-



Figures 16–18. *Psyttalia masneri* sp. n., paratype female, head. **16** Lateral view **17** Dorsal view **18** Face.

ing ventrally; posterior margin weakly crenulate from ventral corner nearly to level of mesothoracic spiracle; surface otherwise completely smooth and polished. Propleural flange small but distinct, flat or nearly so, not strongly bent posteroventrally; not separated from remainder of propleuron by a sculptured groove. Notaulus a small, teardrop shaped dimple, not extending to anterior margin of mesoscutum; scattered setae present around notaulus, extending as a discrete row along lateral margin to tegula and as a somewhat irregular row posteriorly, covering at least anterior 0.5 of disc, with a few, scattered setae extending further posteriorly; mesoscutum otherwise as in *halidayi*. Scutellar sulcus narrow, with 6–7 distinct ridges. Scutellum weakly convex, polished throughout. Metanotum with small median tubercle bearing a low median longitudinal carina. Propodeum coarsely carinate-rugose throughout, with median, bifurcating carina (as in *halidayi*) present but not as readily discernible due to surrounding sculpture, and with portion anteriorad bifurcation shorter; depression separating propodeum from metapleuron poorly defined relative to surrounding sculpture, distinct boss absent adjacent spiracle. Metapleuron and mesopleuron as in *halidayi* except band of setae between subtegular ridge and hind coxa broader, usually extending to hind margin, subtegular ridge less prominently buldging anteriorly, nearly flat, and crenulate precoxal sulcus extending over middle 0.60–0.75 of mesopleuron.

Fore wing (Fig. 13) with stigma about as in *halidayi* except, r nearly equal in length to width of stigma at junction of r; second submarginal cell large, weakly converging distally, 4-sided, m-cu distinctly antefurcal, 2M straight, 2RS reclivous, nearly straight, without medial thickening, r-m completely depigmented and desclerotized; 3RSa 2.3–3.0 × longer than r; r-m and 3RSb essentially as in *halidayi*; (RS+M)a distinctly sinuate, arising further from parastigma than in *halidayi*, 1RS variable, 3.5–5.5 × longer than wide, 0.25 × length of 1M; (RS+M)b not obviously thickened, often partly depigmented, distinctly longer than 1CUa; 1M 1.3–1.4 × longer than m-cu, m-cu straight; 3M tubular basally and usually distinctly pigmented at least over about basal 0.5, spectral and depigmented distally; 1cu-a inclivous, separated from 1M by distinctly less than its own length, 1CUa thickened throughout; 1st subdiscal cell closed, parallel-sided, 2CUa inclivous, less than twice length of tubular, nearly vertical 2cu-a; 1-1A weakly bowed towards wing margin, slightly thickened along portion nearest margin, separated from the latter at that point by 2.0 × its width. Hind wing with RS absent or present only as a very short, basal stub; 2M weakly but distinctly pigmented for most of its length; m-cu absent; 2-1A present but very short.

Metasoma (Figs 21, 22) with petiole 0.95–1.10 × longer than apical width, apex 1.9–2.0 × wider than base; dorsal carinae extending over about basal 0.8 of petiole, slightly converging throughout, bordering median elevation posteriorly, outline of dorsal carinae and median elevation tapered posteriorly, not hour-glass shaped, in dorsal view; sculpture and contour otherwise as in *halidayi* except scupture more evident posteromedially; dorsal and lateral carinae meeting at base above small, round laterope, dorsope absent. T2 distinctly shorter than T3; portion of T2 median tergite on which spiracle resides not clearly delimited from rest of median tergite. Hypopygium weakly sclerotized medially, folded along midline; long, with posterior margin strongly

protruding medially, extending to tip of metasoma; densely covered with long, nearly erect setae. Ovipositor protruding distinctly beyond metasoma, 2.0 × longer than mesosoma, upper valve with low but distinct subapical node, the node relatively short, blunt; ovipositor sheath 1.4 × length of mesosoma, with setal pattern as in *halidayi*.

Figures 19–22. *Psyttalia masneri* sp. n., paratypes. **19** Male habitus, showing natural color **20** Female habitus **21** Propodeum and petiole, dorsal oblique view, showing natural color **22** Propodeum and petiole, dorsal view.

Color. Antenna, labrum, mesothorax, most of pronotum, at least margins of metanotum, fore and middle trochanters, trochantelli, femora, and tibiae, most of hind tibia, hind tarsomeres 1–4, and basal 0.9 of ovipositor sheath black; apical teeth of mandible, vertex, occiput, and sometimes frons medially, small area ventrad mesopleural sulcus, tegula often, and middle portions of metanotum brown to reddish brown; remainder of head and most of metasoma dorsally yellow; palps, small spot near middle of anterior margin of pronotum laterally, hind coxa, trochanter, and trochantellus, all of metapleuron, propodeum, and petiole, and remainder of metasoma pale yellow to white; propleuron yellow, though often extensively infumate; apical 0.1 of ovipositor sheath usually orange; fore and mid coxae usually dark brown apically, yellow to pale yellow basally; fore and mid tarsomeres dark yellow to yellow brown; posterior face of mid femur often variegated dark brown and yellow; hind femur pale yellow with apical dark spot dorsally, hind tibia dark brown to black, usually with dis-

Figures 23–26. Mandibles and lower face. **23** *Psyttalia masneri* sp. n., paratype **24** *Psyttalia leveri* (Fullaway) **25** *Psyttalia halidayi* sp. n., paratype **26** *Psyttalia* sp. near *vittator*.

crete basal/subbasal and median yellow spots dorsally; hind tarsus with fifth tarsomere dark yellow; wings lightly but distinctly infumate throughout, stigma and veins black except most of M+CU usually brown to dark brown.

Male (Fig. 19) as in female except as follows: antenna a little shorter, 5.9–6.0 mm, with 43–45 flagellomeres; eye/temple ratio more variable, in lateral view eye 4.1–4.6 × longer than temple; malar space 0.55–0.60 × width of clypeus; fore wing 3RSa 2.6–2.8 × longer than r; petiole more slender, 1.10–1.25 × longer than apical width, apex 1.65–1.80 × wider than base. Color as in female except T7–8 dark brown to black and propleuron yellow.

Biology. Reared from larvae of *Taomyia marshalli* Bezzi infesting fruits of *Dracaena fragrans* in Kakamega Forest (see material examined section for details). Collections of *Dracaena* in other localities in Kenya yielded *Taomyia*, but no *P. masneri*. Emergence, as in all known opiines, was from the host puparium. Unlike most of the fruit-infesting tephritid hosts attacked by opiines, *T. marshalli* normally pupates in the host fruit and the pupa has an unusually flattened, operculum-like anterior end. An apparently undescribed braconid from the subfamily Braconinae, similar in color to *P. masneri*, was also reared from fruits of *D. fragrans*.

Diagnosis. *Psyttalia masneri* is distinguished from other members of the genus by the distinctive color pattern (Figs 19, 20), broad malar space, sculptured gena, rugose propodeum, and fore wing (RS+M)b without appreciable thickening. It most closely resembles *P. alleni* and *P. paralleni*, both of which have dark metasomas in contrast to the pale metasoma of *P. masneri*. *Psyttalia paralleni* and *P. masneri* both have distinctive sculpturing on the lower gena, though the pattern is more rugose in *P. paralleni* and more striate in *P. masneri*. The ovipositor is also longer and the body more slender in *P. paralleni* than in *P. masneri*.

Remarks. This distinctive species, as noted above, shares characters with members of both the *concolor* and *vittator* species groups. Like members of the *concolor* group, *P. masneri* attacks fruit-infesting tephritids and the fore wing (RS+M)b is well developed. The large malar space, narrow clypeus, and somewhat shorter mandibles, however, are more characteristic of species in the *vittator* group. The propodeum can be rugose in both groups, but the coarse sculpture of *P. masneri* is more typically found in the *vittator* species group. Because of this somewhat intermediate position, I included it with *P. paralleni* in a separate species group (see species group section above). Sequence data for this species (as DQ538415) were used in the analysis by Wharton et al. (2006), confirming it's relatively isolated position compared to other fruit-infesting *Psyttalia* used in that analysis. Additional information on partitioning of the sequence data can be found on-line in Yoder and Gillespie (2004), where *P. masneri* appears as wasp 69.

Unlike *P. halidayi*, *P. masneri* exhibits very little sexual dimophism in color pattern. The propleuron, which is not completely visible in most specimens, is yellow in males and is extensively infumate in most females (though largely pale and thus more similar to males in the holotype). Females exhibit additional variation in the color of the mid tibia, which is somewhat variegated but

largely pale on the posterior face in two specimens. Members of the *concolor* and *fletcheri* species group often have the apex of the ovipositor sheath pale in color, with the remainder black. This is true for most, but not all of the females of the *P. masneri* type series.

This distinctive species is named for Lubomír Masner for his enthusiastic dedication to the study of Hymenoptera in general and "proctos" in particular, and for his tireless efforts to promote collections-based research. I take particular pleasure in making this dedication as I am one of the many people to whom Lubo provided encouragement and support during the early part of their careers.

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